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BRADLEY FIGHTING VEHICLE (BFV) DRIVER TRAINER

TRAINING DEVELOPMENTS STUDY (TDS)

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Ft Benning, GA, 31905-5593

STUDY GIST
BRADLEY FIGHTING VEHICLE DRIVER TRAINER
TRAINING DEVELOPMENTS STUDY

PRINCIPAL RESULTS: BFV drivers are not significantly contributing to BFV mechanical or transmission malfunctions; there would be minimum or no reduction in operating and support costs if a driver trainer were adopted for use due to minimum mileage being devoted to driver training at the institution and in BFV equipped units; exclusive use of a driver trainer for the BFV at battalion or brigade level would result in the device being idle for extended periods; and no driving tasks were selected for training via a simulation device.

MAIN ASSUMPTIONS: driver training and resources sampled were representative of the 11M force; and estimated costs were based on best available information.

MAJOR LIMITATIONS: lack of time and personnel to observe 19D driver training at Ft Knox, KY; full life cycle cost estimates of driver trainers were not available; and unit driver training was indirectly assessed by interviews and questionnaires rather than by direct observation.

THE SCOPE OF THE STUDY: examined driver training at USAIS/C, USAREUR, and FORSCOM units. Input was obtained from battalion command and staff officers, company/troop commanders, 11M instructors, Bradley commanders, and drivers. Other relevant information concerned accidents, vehicle use, and three classes of driver trainers.

STUDY OBJECTIVES: to determine the need for a driver trainer, and determine if a driver trainer would be a cost-effective means of instruction for BFV drivers.

THE METHODOLOGY: identified BFV driving tasks/subtasks, and assessed the effectiveness of driving instruction at the institution and in the unit. This was accomplished by formal observation of the 11M Bradley Basic Course at Ft Benning and in BFV units by questionnaires and interviews with command, supervisory, instructor, and BFV crew personnel. Maintenance records and safety reports were perused to determine vehicle use and damages. A review of literature on motion simulators was conducted. An estimate was made of driver training costs in the institution and in the units, with and without simulators. Driving tasks were subjected to an analytic process for selection to be trained via simulation.

REASONS FOR PERFORMING THE STUDY: BFVs were reported in a nonoperable status due to mechanical and transmission malfunctions allegedly due to improper actions by drivers; and operating and support costs were believed to be excessive and could be reduced by use of a simulator for BFV driving instruction.

STUDY PROPONENT: USAIS, Ft Benning, GA.

STUDY PERFORMING AGENCY: Analysis and Studies Office, Directorate of Training and Doctrine, USAIS, Ft Benning, GA.

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BRADLEY FIGHTING VEHICLE (BFV) DRIVER TRAINER
TRAINING DEVELOPMENTS STUDY (TDS)

1. INTRODUCTION. At the present time, over 1000 Bradleys in the M2 Infantry Fighting Vehicle (IFV) and M3 Cavalry Fighting Vehicle (CFV) models constitute the U.S. Army inventory of this weapon system. By 1991, in excess of 3500 Bradleys will form a primary component of the allied army's deterrent to enemy forces. Bringing the Bradley Fighting Vehicle (BFV) to its maximum combat capability requires effective training, especially for the members of its three-man operating crew, the Bradley commander (BC), gunner, and driver. In the battlefield environment, safe movement of the BFV is the responsibility of the driver who must be prepared to successfully negotiate any terrain or tactical situation that may be encountered.

a. PURPOSE. The study was initiated by the United States Army Infantry School (USAIS), Ft Benning, GA to determine the feasibility of using a training device as a cost-effective means of instruction for BFV drivers. The table of organization and equipment (TOE) identifies BFV drivers as either pay grade E-3 or E-4 with Military Occupational Skill (MOS) 11M10 specified for the IFV and MOS 19D10 for the CFV. Use of a driver trainer device, in both institutional and unit training, was examined.

b. PROBLEM.

(1) Bradleys attached to United States Army, Europe (USAREUR) units were reported in a non-operable status due to mechanical and transmission malfunctions allegedly due to lack of driver skill in operating the vehicles.

(2) The operating and support (O&S) cost for the BFV was believed to be excessive. One suggestion for reducing this expenditure was the use of a simulator (training device) for instruction of BFV drivers.

c. IMPACT OF THE PROBLEM.

(1) M2/M3 Bradleys in a non-operable status seriously deteriorate the ability of allied armies to engage enemy forces. Every training event must be directed at providing an optimally prepared combat force.

(2) An excessive O&S cost could restrict operating tempo and reduce the combat capability of Bradley equipped units.

2. SCOPE. The study addressed those tasks and events directly related to vehicle movement, training of the driver at the institution and unit levels, costs associated with present driver instruction, transmission and mechanical malfunctions, accidents directly related to driver culpability, vehicle usage for driver training, command and supervisory personnel views of driver training, and the estimated cost of driving simulators.

a. LIMITS.

(1) Due to time constraints, institutional training of MOS 19D10 soldiers at Ft Knox, KY was not observed and only general inferences are made regarding M3 driver training.

(2) All BFV equipped units were not involved in the study.

(3) Detailed costing of 11M10 institutional and unit training could not be conducted within the time frame of the study.

(4) Required fidelity (the degree to which the simulator should replicate the actual vehicle) was not determined due to the lack of personnel to adequately research and assess this factor.

(5) Full life cycle cost estimates for three classes of a BFV driver trainer were requested but not received due to lack of time for a contractor to adequately prepare the document for the Project Manager for Training Devices (PM TRADE) to meet the given suspense. Research and development (R&D), production and O&S cost estimates at a rough order of magnitude (ROM) for three different classes of driver trainers were supplied by PM TRADE based on available information for similar devices.

(6) Driver training in units was not observed, but was indirectly assessed by interviews and questionnaires to command, supervisory, and operator personnel.

b. ASSUMPTIONS.

(1) Data collected from a sample of fielded Bradley equipped units were representative of the Bradley force.

(2) Instruction observed in the MOS 11M10 Bradley Basic Course (BBC) at Ft Benning was typical of all 11M10 instruction.

(3) All costs are in constant fiscal year 1985 (FY85) dollars.

c. TERMS. For the purpose of this report, "training device", "simulator", and "driver trainer" are considered to be interchangeable phrases.

3. OBJECTIVES.

a. Determine the need for a driver trainer.

b. Determine if a driver trainer would be a cost-effective means of instruction for BFV drivers.

4. <u>ESSENTIAL ELEMENTS OF ANALYSIS (EEA)</u>.

a. EEA 1. What driving tasks and subtasks must an M2/M3 driver perform?

- Driving tasks and subtasks, ranging from starting and stopping the vehicle through tactical driving, were identified. Dependencies among the tasks, as well as the skills and knowledge required to perform the tasks, were determined.

b. EEA 2. How are M2/M3 drivers trained?

- A description of the 11M10 BBC, including driver tasks and subtasks trained at the institutional level, was compiled. The training of driving tasks and subtasks in Bradley equipped units was examined. Vehicle usage was compiled from maintenance records of units in the study and from a survey of the Bradley force by Army Materiel Command (AMC).

c. EEA 3. What is the effectiveness of present M2/M3 driver training?

- The pass/fail rate of students in the 11M10 BBC was documented from the end-of-course examination.

- Subjective statements of current driver training programs were obtained from command, supervisory, and instructor personnel. Discrepancies between actual performance frequency and recommended sustainment frequency were determined from driver responses on survey instruments.

d. EEA 4. What mechanical malfunctions and accidents are caused by M2/M3 drivers?

- Mechanical malfunctions caused by drivers were documented from maintenance records and interviews with maintenance and command personnel. A statement was obtained from the transmission manufacturer regarding driver culpability for transmission failures. Systems Assessment Reviews (SAR) and product improvement program (PIP) were perused for relevant data and information. A report on accidents involving Bradleys was obtained from the U.S. Army Safety Center.

e. EEA 5. What are the costs and resources associated with M2/M3 driver training?

- Institutional and unit driver training costs were estimated. Available resources were obtained from survey instruments and observation.

f. EEA 6. Which driver tasks and skills are candidates for a driver trainer?

- Data were obtained from the field, BBC instructors, and subject matter experts (SME) and applied to the methodology for selecting tasks/subtasks to be trained on simulators.

g. EEA 7. How effective are simulators for training in lieu of, or in combination with, actual equipment?

- A literature review was conducted of training simulators, learning transfer from simulators to actual equipment, and foreign military services' use of tracked vehicle driving simulators.

h. EEA 8. What are the costs and resources associated with a driver training device?

- ROM costs were obtained for R&D, production, and O&S for three classes of driver training devices.

i. EEA 9. What training alternatives are available or could enhance present driving instruction?

- Use of training aids in institutional training was documented as was the need for additional resources. Consideration was also given to use of a surrogate vehicle for driver training.

j. EEA 10. What is the cost of using simulators versus vehicles for M2/M3 driver training in the institution and in BFV units?

- Institution and unit training costs using the actual vehicles were compared to the costs of training using a driver trainer.

5. METHODOLOGY.

a. FRONT-END ANALYSIS. Training and Doctrine Command Job and Task Analysis Worksheets (TRADOC Form 550) for the BFV were updated and revised in order to identify driver tasks, dependencies among the driving tasks, and the knowledge and skills necessary for performing the driving tasks.

b. INSTITUTIONAL TRAINING AT FT BENNING. Tasks and subtasks trained in the 11M10 BBC were extracted from the approved 11M program of instruction (POI). BBC instruction was observed with student driving instruction as the focus for recorded data. Detailed descriptions of the methodology and results are included in Appendix A. The questionnaire administered to BBC instructors is included in Appendix B. A modified POI for this course is being tested that reduces the length of the course from 3 weeks to 2 weeks with a resultant decrease in driver training.

c. UNIT TRAINING.

(1) Data Sources/Sample. The current and projected fielding of the Bradley force was obtained from the TRADOC Systems Manager for Bradley Fighting Vehicles. FORSCOM and USAREUR corps area commanders were each requested to designate two Bradley equipped mechanized infantry battalions as the cooperating units for the study. Due to training commitments at the designated FORSCOM post, one Bradley equipped cavalry squadron substituted for one mechanized infantry battalion.

(2) Interviews/Questionnaires. Survey forms developed and tested by the study agency were administered to 116 personnel in FORSCOM and USAREUR Bradley equipped units. Battalion commanders, brigade and battalion S-3 operations officers, battalion/squadron maintenance officers, and company/troop commanders were sampled by personal interview. Eleven BC, including platoon leaders and platoon sergeants, and 11 BFV drivers were interviewed with the remainder of the sample completing questionnaires. The forms used for written questionnaires and interviews differed only in the mode of data collection, not in format. Forms used for this effort are included in Appendix B. Sample size is found in Table 1. Detailed demographic information is in Appendix C.

Table 1

SAMPLE SIZE

UNIT PERSONNEL SURVEYED	FORSCOM	USAREUR
Battalion/Squadron Commanders	1	2
S-3 operations officers (Brigade & Battalion)	2	4
Battalion/Squadron Maintenance Officers	2	2
Company/Troop Commanders	3	4
M2/M3 Bradley Commanders	22	30
M2/M3 Bradley Drivers	22	22
TOTAL (n=116)	52	64

d. MAINTENANCE RECORDS. Units participating in the study provided information on assigned BFVs. Data were compiled on 180 vehicles and included the following: date placed in service, hours of operation, recurring maintenance problems, and O&S cost per year per vehicle. The form used for the collection of this information is included at Appendix B.

e. COST ANALYSIS.

(1) Institution. Cost per student was estimated based on mean kilometers driven by the student multiplied by the standard O&S cost per kilometer for the BFV as provided by AMC. A factor for vehicle movement from storage to training sites was also included. Yearly O&S costs were then calculated from these two factors and enrollment projections.

(2) Unit. The cost of operating the BFV for driver training in a fielded unit was estimated by determining mean kilometers driven for driver training (based on survey instruments) multiplied by AMC standard O&S cost per kilometer for BFV.

(3) Training Device. Costs of the training devices for three classes of simulation were provided by PM TRADE, Orlando, FL. The cost report is at Appendix D.

f. OTHER DATA SOURCES.

(1) Literature review was conducted by a computer search of relevant articles and studies from the Defense Technical Information Center (DTIC).

(2) Review of foreign military services use of driver simulators was compiled by U.S. Army Foreign Science and Technology Center, Charlottesville, VA, and by personal interview with liaison officers at USAIS.

(3) Accident reports involving M2/M3 Bradleys over a 3-year period were provided by U.S. Army Safety Center, Ft Rucker, AL.

(4) Data on vehicle usage were provided by Tank and Automotive Command (TACOM).

6. DATA ANALYSIS/RESULTS.

a. EEA 1. What driving tasks and subtasks must an M2/M3 driver perform?

(1) Major Tasks.

(a) The major tasks necessary for the driver to accomplish movement of the M2/M3 were extracted from the 11M10 Soldier's Manual (1982) and the individual task analysis forms. Due to the complexity of the task, drive a Bradley M2/M3, it was subjected to further breakdown resulting in an additional task, tactically drive a Bradley M2/M3. The major driving tasks are listed in Table 2. (See page 8)

(b) The dependencies among these tasks are illustrated in Figure 1.

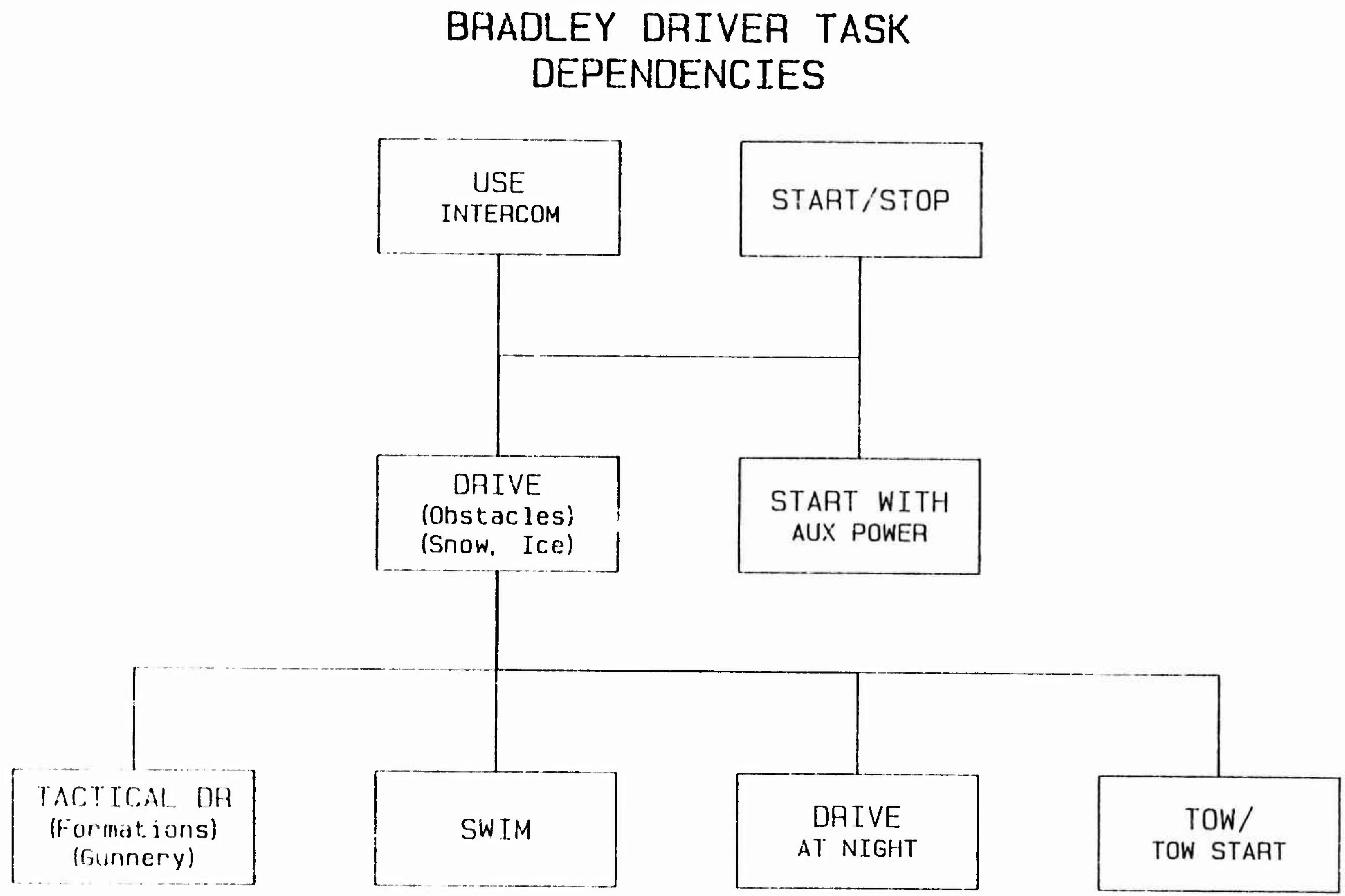
BRADLEY DRIVER TASK
DEPENDENCIES
USE
INTERCOM
START/STOP
DRIVE
(Obstacles)
(Snow, Ice)
START WITH
AUX POWER
TACTICAL DR
(Formations)
(Gunnery)
SWIM
DRIVE
AT NIGHT
TOW/
TOW START

FIGURE 1

Table 2

MAJOR TASKS PERFORMED BY M2/M3 BFV DRIVERS

SOLDIER'S MANUAL #	TASK TITLE
113-622-2009	Operate intercommunications set AN/VIC-1 on a Bradley M2/M3 fighting vehicle
071-324-6031	Start/stop the engine on a Bradley M2/M3
071-324-6025	Start a Bradley M2/M3 engine using auxiliary power
071-324-6021	Tow/tow start a Bradley M2/M3
071-324-6001	Drive a Bradley M2/M3
	Tactically drive a Bradley M2/M3
071-324-6033	Drive a Bradley M2/M3 using night vision equipment
071-324-6019	Operate a Bradley M2/M3 in water.

(c) Communication between the BC and the driver via the combat vehicle crewman's (CVC) helmet and intercom is of paramount importance due to the limited sight line of the driver on the right side of the vehicle and for anticipating procedures necessary to coordinate with tactical movements of the Bradley platoon. To operate the intercom, the master power switch must be ON. This switch is located in the driver compartment on the instrument panel and thus becomes a logical starting point for the training of drivers.

(d) Procedures for stopping and starting the engine require knowledge of the driver compartment, instrument console, and the location and operation of all switches, levers, gauges, pedals and indicators. This task can be performed without the intercom in operation and is, therefore, placed as another starting point for driver training.

(e) Starting with auxiliary power requires knowledge of the normal start procedures but does not necessarily require the use of the intercom.

(f) As indicated in Figure 1, all other driving tasks beyond these tasks require the knowledge and procedures of the two initial tasks--operate intercommunications set AN/VIC-1 and start/stop the engine on a Bradley M2/M3.

(2) Subtasks. For the purposes of the study, the general category, drive a Bradley M2/M3, was determined to be composed of nine subtasks, with tactically drive a Bradley M2/M3 also composed of nine subtasks. Twenty-six tasks/subtasks were identified. Bradley drivers, commanders, and BBC instructors were asked to list any other driving tasks or subtasks not previously identified. None was added. The task/subtask inventory presented to respondents is contained in Table 3.

Table 3

DRIVING TASKS AND SUBTASKS FOR THE M2/M3 BFV

MAJOR TASKS	DRIVING TASKS & SUBTASKS AS LISTED ON TASK INVENTORY
Operate Intercom	Operate intercom
Start/Stop	Start M2/M3 using normal start
	Stop/shut down M2/M3
Start M2/M3 using auxiliary power	Start M2/M3 using auxiliary power
Tow/tow start a Bradley M2/M3	Tow a disabled vehicle
	Start M2/M3 using tow start
Drive a Bradley M2/M3	Drive M2/M3 in urban area
	Drive M2/M3 in desert area
	Drive M2/M3 in wooded area
	Drive M2/M3 on slopes
	Drive M2/M3 on ice/snow/slick roads
	Drive M2/M3 in water < 3.5 feet
	Drive M2/M3 in a mined area
	Load M2/M3 on transporter/rail car
	Perform pivot turns with M2/M3
Tactically drive a Bradley M2/M3	Drive M2/M3 in column formation
	Drive M2/M3 in wedge formation
	Drive M2/M3 in vee formation
	Drive M2/M3 in line formation
	Drive M2/M3 in echelon formation
	Drive M2/M3 to a coil halt
	Drive M2/M3 to a herringbone halt
	Maintain stable platform for firing
	Perform evasive tactics with M2/M3
Operate a Bradley M2/M3 in water	Swim the M2/M3
Drive a Bradley M2/M3 using night vision equipment	Drive M2/M3 w/night vision equipment

(3) Knowledge and Skills. The knowledge and skills required by drivers to accomplish the aforementioned tasks and subtasks were derived from the task analysis as contained on TRADOC Form 550 (Job and Task Analysis Worksheet) for the M2/M3 BFV and are detailed in Appendix E. The learning analysis indicated the driver has many switches, levers, gauges, pedals, and indicators to locate and operate. Coordination of feet, eyes, and hands is necessary to operate the vehicle in a smooth manner. An example of the most

difficult coordination is evidenced in the subtask--perform pivot turns--which requires the driver to hold the gear selector in the PIVOT TURN position with the right hand, while steering with the left hand and maintaining a steady pressure with his right foot on the accelerator pedal.

b. EEA 2. How are M2/M3 drivers trained?

(1) Institutional Training.

(a) Observation of the training for MOS 11M10, Fighting Vehicle Infantryman, occurred at Ft Benning, GA. The BBC covers many phases of 11M10 training, but only the aspects directly related to driving the BFV are included in this report. Specific details of the observation and a description of the driving range are found in Appendix A. During the observation period, the POI (April, 1984) allowed for 125 hours of instruction, covering a 3-week period. Based on a class size of 36 students, the student to instructor ratio is 6:1. Each group of six students is assigned to one vehicle with a student to vehicle ratio of 6:1. Instruction directly related to driving is detailed in Table 4.

Table 4

PEACETIME PROGRAM OF INSTRUCTION (POI)
FOR 11M10 BRADLEY BASIC COURSE (BBC)
(125 HOURS)

DRIVING INSTRUCTION	TIME IN POI (HOURS)				PER STUDENT[1]	
SEGMENT	TOTAL	CLASS	DEMO	HANDS-ON	KM	TIME
BFV communications	3.0	.5	.5	2.0	0.0	n/a
Hand and arm signals	2.0		.5	1.5	0.0	n/a
Start/stop BFV engine	3.0	.5		2.5	0.0	n/a
Drive the BFV	8.0	.7	.3	7.0	2.0	8'38"
Tow/tow start the BFV	1.5		.5	1.0	0.0	n/a
Start BFV w/aux. power	1.5		.5	1.0	0.0	n/a
Drive w/night vis.equip.	5.5		.5	5.0	1.0	6'21"
Swim the BFV[2]	8.0		1.0	7.0	0.5	3'28"
Convoy operations[3]	4.0	.5		3.5	2.0	34'01"
Drivers proficiency test	4.0	.5		3.5	2.0	7'35"
TOTAL	40.5	2.7	3.8	34.0	7.5	60'03"

[1] Based on results of recorded observations.

[2] At the time of the observations, only two Bradleys were available for this activity.

[3] This segment contains formation and terrain driving. Only five vehicles were used due to one developing mechanical problems.

(b) Based on the total amount of instruction time per class (125 hours), driver training accounts for 32% (40.5 hours) of the BBC.

(c) Data collected during observations of the BBC resulted in mean kilometers driven of 7.5 and a mean of 60'03" of driving time per student. All driver training uses actual BFVs.

(2) Unit Training. Description of unit training was compiled from survey instruments and personal interviews with battalion/brigade S-3 operations officers, company/troop commanders, and Bradley commanders and drivers.

(a) Being the driver for a BFV is a much sought after and highly competitive position. Some units have specific criteria for selecting the primary driver which may involve a recommendation from the BC or platoon sergeant to the company/troop commander. The individual must demonstrate his ability to perform as a "good soldier"; be responsible for preventive maintenance, checks, and services (PMCS); carry out the instructions of the BC; and always operate the vehicle in a safe manner. Primary drivers are licensed to operate the BFV, and notice to that effect is recorded on Equipment Operator's Qualification Record DD Form 348. In most units, only certain individuals are authorized to make the appropriate entries for certifying the driver's ability. Thirty-six percent of the drivers in the study had received their instruction through new equipment training teams (NETT). Graduates of the BBC when assigned to a BFV unit will most likely be assigned to the dismount element. New primary drivers will be selected from those soldiers who have been in the unit for a period of time. Turbulence for drivers in Bradley units ranges from 80 to 100 percent per year due to promotion or rotation. The position of driver is not without its drawbacks such as the difficulty in performing when using mission-oriented-protective-posture (MOPP) gear, and driving fatigue especially after several hours of speed marches, necessitating the use of alternate drivers. Training of alternate drivers and crosstraining is, for the most part, a function carried on by the BC. All driver training is accomplished using the actual BFV.

(b) Brigade and battalion S-3 operations officers indicated no specific time was allotted in unit training schedules for driver training. On-the-job-training (OJT) and inclusion as part of crew training were the primary means of training drivers.

(c) Company/troop commanders were divided on whether there was specific time in the unit training schedule for driver training. The opposing views between S-3s and company/troop commanders regarding specific time for driver training in unit training schedules are unexplainable at this time. Some company/troop commanders offered OJT and incorporation into crew training as alternatives. Others indicated from 2 hours to 2 days per month were devoted to driver training, logging anywhere from 3 to 50 kilometers.

(d) Driver training ranges are available for NETT as well as FORSCOM and USAREUR units. Use of these driving ranges was not determined. Most driver training ranges included the following obstacles:

trenches, slopes, mud, water less than 3.5 feet, water deeper than 3.5 feet, simulated minefield, woods, abatis, tank ditch, urban terrain, and (weather permitting) snow, ice, and rain slick roads.

(e) Drivers indicated that a maximum of 10 percent of their weekly driving is devoted to driver training. This estimate is high when compared to S-3 and company/troop commanders' responses on conduct of driver training in the units. It should be noted that one-third of the drivers indicated no regular program of driving instruction was included in their training. Gunnery exercises, field training exercises, and ARTEP accounted for 60 percent of driving with the remainder in road marches and motor pool driving.

(3) Vehicle Usage.

(a) BFV usage varies according to operating tempo and locale of vehicle assignment. The per month usage in kilometers driven, hours of operation, and fuel consumed is in Table 5.

Table 5

SUMMARY OF M2/M3 BFV USAGE

CATEGORY	AMC	USAREUR	FORSCOM
Avg kms per vehicle per month	170	193	164
Avg hrs per vehicle per month	32	38	26
Avg fuel consumed per month (gals)	179[1]	86[2]	90[2]
Number of vehicles surveyed	262	120	60

[1] Fuel consumption was based on 1.2 km per gallons per AMC data.

[2] Fuel consumption for USAREUR and FORSCOM was based on 1.9 km per gallon based on data collected from units in the survey.

(b) AMC data are based on a random sample of the entire Bradley force. USAREUR and FORSCOM data are based on information obtained from units visited during the conduct of the present TDS. The collected data closely correspond with that provided by AMC, i.e., 170 km driven per vehicle per month.

(4) Tasks/Subtasks Trained.

(a) The tasks and subtasks trained in the BBC and in Bradley units are enumerated in Table 6. Also cited is the percentage of drivers in BFV units that typically perform each task/subtask, and the frequency of performance. Frequency of performance was determined by the category (annually, semi-annually, quarterly, monthly, weekly, daily) in which approximately 50 percent of the drivers responded. All driving instruction is conducted on actual vehicles.

Table 6

M2/M3 DRIVING TASKS AND SUBTASKS TRAINED IN
THE BRADLEY BASIC COURSE AND IN BFV EQUIPPED UNITS

TASK/SUBTASK	WHERE TRAINED BBC	WHERE TRAINED UNIT	UNIT % SOLDIERS PERFORMING	UNIT FREQ OF PERF
Start M2/M3 using normal start	x	x	100	daily
Stop/shut down M2/M3	x	x	100	daily
Perform pivot turns with M2/M3	x	x	100	daily
Operate intercom	x	x	98	daily
Drive M2/M3 in wooded area	x	x	98	monthly
Drive M2/M3 w/night vision equip	x	x	98	monthly
Start M2/M3 using auxiliary start	x	x	96	monthly
Drive M2/M3 in column formation	x	x	96	monthly
Drive M2/M3 in line formation		x	95	monthly
Drive M2/M3 on slopes	x	x	89	monthly
Drive M2/M3 in wedge formation	x	x	88	monthly
Drive M2/M3 in vee formation	x	x	77	monthly
Drive M2/M3 in echelon formation	x	x	75	monthly
Drive M2/M3 in water < 3.5 feet	x	x	75	monthly
Start M2/M3 using tow start	x	x	75	annually
Maintain stable firing platform		x	73	quarterly
Drive M2/M3 to a herringbone halt		x	71	monthly
Perform evasive tactics on M2/M3		x	69	monthly
Swim the M2/M3	x	x	66	annually
Tow a disabled vehicle	x	x	64	annually
Drive M2/M3 in urban area		x	62	monthly
Drive M2/M3 on ice/snow/slick rds		x	57	quarterly
Drive M2/M3 to a coil halt		x	50	monthly
Load M2/M3 on transporter/rail car		x	48	annually
Drive M2/M3 in desert area		x	39	monthly
Drive M2/M3 in mined area		x	9	annually
TOTAL	16	26		

(b) It must be noted that the driving tasks and subtasks taught in the BBC are primarily an orientation to what is expected when assigned to a Bradley unit. Qualification and certifying (licensing) of drivers is performed only in the units. This practice was endorsed by unit commanding officers and supervisory personnel interviewed in the study.

(c) The majority of the tasks/subtasks are performed by all unit BFV drivers, while other tasks/subtasks are dependent on climate, available terrain, or operation commitments.

(d) Tasks/subtasks not trained in the BBC (i.e. drive on ice/snow/slick roads, stable platform for firing) are predicated on the lack of experience in controlling the vehicle, non-availability of terrain, weather conditions, and/or priority of other phases of the MOS training.

c. EEA 3. What is the effectiveness of present M2/M3 driver training?

(1) Institutional Training. For the observed students in the BBC, the pass rate was 100% based on the end-of-course examination. This was typical of the 80 to 100% pass rate of previous BBC classes. However, instructors for the BBC indicated a need for improving instruction by increasing the time span for driving, establishment of a separate driving school, inclusion of more terrain and formation driving, and/or eventual licensing of drivers at the end of this period of instruction. There was no consensus on these options. Instructor responses relating to difficulty, both in teaching and students performing the tasks and subtasks in the BBC, are listed in Table 7. These data show that instructors perceive no apparent difficulty in teaching driving tasks nor in the students performing the tasks.

(2) Unit Training.

(a) Reaction by Command and Supervisory Personnel.

1. Battalion commanders commented on the effectiveness of the current system of driver training by stating there is not enough driving in the BBC, a need for more tactical and terrain driving, and the need to drive in obscuration. One battalion commander perceived no basic problems in the current system, but emphasized the need for coordinating driver and BC actions. S-3 opinions ranged from the need for increasing driver training, satisfactory now, and no additional time needed in the institution assuming that the units are capable of doing good training. More driving practice with the night vision equipment was perceived as a need by a battalion maintenance officer. Company/troop commanders expressed their overview of driver training as being satisfactory, more driver training needed in the BBC, remain as is due to each unit having its own problems and requirements, and that the current strategy works well.

2. In summary, there was an equal division among those surveyed as to the effectiveness of the current practice for training M2/M3 drivers; 50% responded with positive statements and 50% responded with he need for improvements.

Table 7

INSTRUCTORS' RATINGS OF DIFFICULTY OF TEACHING TASKS AND OF DIFFICULTY OF STUDENTS PERFORMING TASKS TAUGHT IN THE BRADLEY BASIC COURSE

TASK/SUBTASK	TEACHING "Somewhat Easy to Very Easy" % RESPONDING	PERFORMING "Somewhat Easy to Very Easy" % RESPONDING
Stop/shut down M2/M3	100	94
Start M2/M3 using normal start	94	94
Perform pivot turns with M2/M3	94	94
Drive M2/M3 in wedge formation	94	94
Drive M2/M3 in vee formation	94	94
Drive M2/M3 in echelon formation	94	94
Operate intercom	89	89
Start M2/M3 w/auxiliary power	89	89
Drive M2/M3 in wooded area	89	89
Drive M2/M3 on slopes	89	89
Drive M2/M3 in water <3.5 feet	89	89
Drive M2/M3 in column formation	89	94
Tow a disabled vehicle	83	89
Swim the M2/M3	83	83
Drive M2/M3 w/night vision equip.	77	89
Start M2/M3 using tow start	71	77

(b) Performance Frequency.

1. Drivers were asked to identify how often tasks and subtasks were performed in their unit and to identify how often the tasks/subtasks should be performed to maintain proficiency. The frequency of performance (annually, semi-annually, quarterly, monthly, weekly, or daily) was determined by the particular category in which approximately 50 percent of the drivers responded.

2. Of the 26 tasks/subtasks identified, only 28% (7) were found to have a discrepancy between performance and recommended sustainment. These discrepancies are identified in Table 8.

3. In all but one of these seven tasks the requirement was for more frequent training. Those tasks performed annually, are seen to need a more frequent iteration to maintain proficiency. The response to downgrade Drive M2/M3 in Desert Area to a less frequent occurrence was influenced by the fact that only 18% of USAREUR drivers perform this task. In comparison, 55% of FORSCOM drivers responded where desert driving is a normal occurrence.

Table 8

TASKS AND SUBTASKS WITH A DISCREPANCY
BETWEEN PERFORMANCE AND RECOMMENDED SUSTAINMENT FREQUENCIES

TASK/SUBTASK	PERFORMED	RECOMMENDED SUSTAINMENT
Drive M2/M3 on ice, snow, slick roads	quarterly	monthly
Start M2/M3 using tow start	annually	quarterly
Swim the M2/M3	annually	quarterly
Drive M2/M3 in mined area	annually	quarterly
Tow a disabled vehicle	annually	quarterly
Load M2/M3 on transporter or rail car	annually	quarterly
Drive M2/M3 in desert area	monthly	semi-annually

d. EEA 4. What mechanical malfunctions and accidents are caused by M2/M3 BFV drivers?

(1) Mechanical Malfunctions.

(a) Interviews with BC and maintenance technicians indicated there have been some mechanical problems, especially with BFV transmissions. During night driving when shifting from LOW gear to DRIVE, drivers would inadvertently move the lever to the TOW START position. This problem has been temporarily corrected by the insertion of a rubber stop which must be removed before placing the gear selector into TOW START or TOW positions. This is only an interim measure. A more enduring solution may be found in a re-design of the shift tower currently in progress by the vehicle manufacturer.

(b) Reporting of BFV mechanical malfunctions and transmission seal leaks occurred in USAREUR when the vehicles were allowed to be idle for a long period. While the vehicles were started every day, they were not moved. Later, when the vehicles were placed in operation, mechanical problems erupted and kept recurring for at least a 10 day period. After that time, the mechanical problems decreased to a more normal level. The mechanical problems outlined here were not driver error, but do highlight the need for preventive measures especially during cold weather.

(c) Maintenance technicians confirmed that faulty pilot valves on the transmissions were a primary source of vehicle inoperability. This is clearly a material malfunction not related to driving skill.

(d) A letter from the manufacturer of BFV transmissions reported that eight to ten of approximately 300 transmission failures per year can be attributable to driver error. However, the document goes on to state that this is not completely verifiable (Appendix F).

(e) A product improvement program (PIP) is to be implemented for five transmission components. These component modifications were identified as: redesign of the spool stop, redesign of the actuator filter, redesign steer sector/redesign steer upshift inhibitor, redesign 90 degree fitting, and reidentify steer shaft. Field representatives from the transmission manufacturer estimated the PIP will improve reliability of the transmission by 15 to 20 percent.

(f) Drivers were not completely exonorated in causing transmission or other mechanical malfunctions. It was inferred, from several different sources, that drivers were turning off the warning tones in their CVC helmet. If panel warning lights are inoperative, the driver then has no way of detecting that transmission fluid or operating temperatures are not at the proper levels. Such deficiencies may not be detected until the vehicle comes to an abrupt halt. It was also implied that drivers do not follow correct procedures for cold start, auxiliary start, and tow/tow start. These factors, accompanied by incorrect procedures in the TM and faulty transmission parts, have produced most of the mechanical malfunctions. These deficiencies can be corrected by means other than an expensive driver trainer.

(2) Accidents.

(a) M2/M3 BFV accident reports were collected by the U.S. Army Safety Center from 1 June 1982 until 10 May 1985. During the stated 3-year period, a total of 32 accidents involving Bradley vehicles were reported; an average of 10.7 accidents per year. Forty-two personnel were involved, with no fatalities. Injuries to personnel cost the U.S. Government a total of $71,940 and 6 hospital days. Damage to vehicles amounted to $302,945 with 483 days lost of vehicle operability. Of the 32 accidents reported, 47% (15) may be related to driver error. Causes of BFV accidents were: driver negligence (6), excessive speed (4), inattention of the driver to terrain conditions (3), limited night vision (1), and lack of communication with BC (1).

(b) By comparison, during a 2-year period (FY83 and FY84), 229 M113 Armored Personnel Carrier (APC) accidents were reported, an average of 114.5 accidents per year. During this same time span, 174 accidents were reported involving M60 tanks, an average of 87 accidents per year. In the accident cases cited, M113 APC and M60 tanks, 33% involved driver error.

(c) No major accidents were reported by the units surveyed. However, it was observed by data collection personnel that rear stowage boxes were dented, mangled, or had obviously been replaced. Damage to these items occur when operating in close quarters and woods, especially when making turns.

e. EEA 5. What are the costs and resources associated with driver training?

(1) Institution.

(a) Cost per student (C_i) was estimated by adding a factor for vehicle movement from the storage area to the training sites (v_m), to the mean kilometers driven by each student in the BBC (k_i) multiplied by the standard O&S (o_s) cost per kilometer provided by AMC ($50).

$$C_i = (v_m + k_i)o_s$$

$$C_i = (12.5 + 7.5)\$50$$

$$C_i = \$1,000$$

(b) It is projected that the BBC will accommodate 1500 students per year in FY87. Based on observation data, each student accumulates 7.5 km with a mean driving time of 60 minutes per student. Combined with the factor of moving the vehicles from storage to training sites, this results in a minimum cost of $1,500,000 ($1,000 x 1500) per year for 11M10 driving instruction. This figure does not include construction or maintenance of driving sites and facilities, nor personnel costs. The estimated cost of driving instruction using the approved POI is depicted in Table 9.

Table 9

PROJECTED COSTS FOR 11M 3-WEEK BRADLEY BASIC COURSE DRIVING INSTRUCTION

FY	ENROLLMENT PROJECTION[1]	ESTIMATED COST VEHICLE ONLY[2]
1986	1500 (1336)	$1.5M ($1.3M)
1987	1500 (3680)	$1.5M ($3.7M)
1988	2800 (3990)	$2.8M ($4.0M)
1989	4500 (4600)	$4.5M ($4.6M)
1990	2800 (6440)	$2.8M ($6.4M)

[1] Enrollment projection is based on Army Program for Individual Training (ARPRINT) data. Enrollment figures contained in parenthesis are USAIS, DOTD resident training management division (RTMD) projections.

[2] Estimated cost per student is $1,000 including a factor of moving the vehicles to training sites.

(c) Resources used in the BBC, but not costed, consist of six M2 Bradleys, classroom instruction, slides on overhead projector, taped video presentations, and instructor demonstrations. This instruction is skill level one presentation for MOS 11M. A one kilometer driving course is used and contains left and right turns, hills, ditches, and berms. Terrain driving (woods, slopes) and some formation driving is included in the POI.

(2) Unit.

(a) Cost of operating the BFV in a fielded unit (C_u) for driver training was estimated by multiplying the mean kilometers driven per vehicle per week (k_u); by the maximum percentage of kilometers devoted to driver training (p_u) [does not include OJT, gunnery exercises, motor pool, or road marches]; by the standard O&S cost per kilometer (o_s) provided by AMC.

$$C_u = k_u p_u o_s$$

$$C_u = 42.5 \times .10 \times \$50$$

$$C_u = \$213$$

(b) Based on collected data, a driver in a BFV unit accumulates 4.25 km and 18 minutes of driver training per week. To achieve the same amount of driving time devoted to driver training as a student in the BBC (i.e. 60 minutes), a driver would have to operate the vehicle over a period of 3.3 weeks. The cost would then be $703 ($213 x 3.3), and an accumulation of 14 kilometers devoted to driver training.

(c) If one considers that there are approximately 1500 Bradleys in the field, each requiring a trained driver, the cost for driver training Armywide would approximate $1,054,500 per year (1500 x $703). This would be a minimum cost and does not include cost of training alternate drivers, nor the factor of driver turbulence which ranges from 80 to 100 percent each year. The cost could very well double or even triple.

(d) Resources available for driver training in the units, but not costed, consist of operational M2/M3 Bradleys, appropriate TMs, FMs, defensive driving courses, and driving ranges previously detailed in EEA 2, para 6b(2)(d).

f. EEA 6. Which driver tasks and skills are candidates for a driver trainer?

(1) Army Research Institute (ARI) guidelines for selecting tasks to be trained on a training device were applied to BFV driving tasks/subtasks. The methodology was developed for specifying tasks/subtasks requiring training equipment support and to identify essential device characteristics. The first step in the methodology is to identify and describe the tasks/subtasks performed in the operational environment. All tasks/subtasks requiring training are then evaluated

as to the criticality of that requirement. The tasks/subtasks are then rated to provide an indication of the extent to which initial practice and sustainment training is required to establish and maintain an acceptable skill level in task/subtask performance. The tasks remaining after the screening are then further evaluated against available job aids and conditions affecting task performance. Tasks/subtasks surviving these steps are then subjected to a skills analysis to identify the kinds of skills required to perform the task/subtask. The final step is to determine physical and instructional characteristics that are to be incorporated in the device.

(2) After identifying the driving tasks/subtasks, the ARI Training Requirement Priority Index (TRPI) was obtained by applying driver, BC and SME responses in the categories of task criticality to combat, task newness, and task performance frequency. All 26 driving tasks/subtasks were rated using the TRPI. Through this procedure, nine tasks/subtasks were identified for the next phase of the methodology: drive with night vision equipment, drive in urban area, operate intercom, drive in column formation, drive in wedge formation, drive to a herringbone halt, perform evasive tactics, maintain a stable firing platform, and perform pivot turns.

(3) The Practice Requirement Index (PRI) was then applied using driver and SME responses to rate task performance difficulty, task delay tolerance, and task practice frequency. Application of the PRI index eliminated the tasks/subtasks from further consideration, primarily due to the tasks/subtasks being rated as easy to perform. As no task/subtask survived the first two rating indexes, none was selected for training on a training device. Tabulation and a detailed explanation of these phases are contained in Appendix G.

(4) BBC instructors, through responses to questionnaires, identified 16 tasks/subtasks to be trained on a driver trainer, essentially those currently taught in the BBC.

(5) All study participants were asked if a driver trainer would be effective for training new drivers. Seventy-two percent replied in the affirmative. Inclusion of malfunctions (i.e., loss of steering, thrown track, loss of brakes) in the driver trainer was deemed appropriate by 78 percent of the respondents. Use of the driver trainer for sustainment was agreed to by 57 percent, 26 percent responded in the negative, and 17 percent were undecided. Command, training, and supervisory personnel were vocally adamant in emphasizing that the vehicle, not the simulator, must be used for sustainment training.

(6) Command personnel perceived minimal or no reduction in driving mileage if a driver trainer were available.

g. EEA 7. How effective are simulators for training in lieu of, or in combination with, actual equipment?

(1) A limited literature review of training simulation supported the hypothesis that, in general, minimum negative learning

transfer occurs from training simulation to actual equipment. Only one study, conducted by a foreign army, compared success of tracked vehicle operation of drivers trained on simulators to drivers trained on actual vehicles. The criteria of success was based on an examination given to drivers. Details of the examination were not identified though it is implied that the test was both hands-on and written.

(2) Interviews with foreign military liaison officers at USAIS and a review of literature on foreign armies' use of driving simulators revealed that several countries are using these devices to train drivers for armored tracked vehicles. Principal countries using these simulators include Great Britain, France, Germany, Belgium, Holland, Spain, Turkey, and Italy. Initial purchase price is quite high, but savings associated with the use of these simulators for driver training are also reported. Some reported advantages of using these simulators are: reduced training cost, shorter training sessions, decrease in accidents, and an independence from weather conditions. The tracked vehicle driver training programs of most foreign armies use a combination of approximately two-thirds simulator time and one-third time on the actual vehicle. A typical foreign army driver training program lasts 10 days with approximately 8 hours on the simulator and 4 hours on the vehicle. Abstracts of the literature review are contained in Appendix H.

(3) Foreign armies tracked vehicle driver training is conducted, for the most part, at centralized driving schools. Soldiers completing those courses are assigned to units as drivers and stay in that position in excess of 2 years. The driver is responsible for the operational status of the vehicle. A sense of pride is instilled in that soldier knowing that the machine's availability is dependent on his driving skill and timely maintenance procedures.

(4) Driving tasks for the American soldier are similar to previous experiences as a civilian, in that it is rare to have a trainee who has not been exposed to, and operated a motor vehicle. Use of simulators for training aircraft pilots is justified in that the reverse is true. It is rare to find a pilot trainee who has previously operated modern aircraft. This situation is comparable to soldiers in foreign armies, where trainees have a minimal and probably non-existent experience in driving any type of motorized vehicle, in which case driving via simulators is justified.

h. EEA 8. What are the costs and resources associated with a driver training device?

(1) ROM costing for three classes of driver trainers--part task, limited task, and full task--was compiled by PM TRADE, Naval Training Center, Orlando, FL (See Appendix [illegible]). The driver trainers under consideration are classroom type, housed in a structure.

(a) A part task trainer is projected to be of low complexity, capable of replicating the procedures for starting, stopping, engine revolutions per minute (RPM) control, braking, and turning. The device would be a single station unit and is considered a low cost risk. Visual presentation would be a fixed, pre-recorded line of travel. This device would permit introductory training. However, based on the description provided and activity built-in to this device, it appears there would be no decrease in vehicle usage for driver training.

(b) A limited task trainer would be of mid-complexity with full interaction for all cockpit switches, indicators, and controls (steering, acceleration, braking, turning). An interactive visual display with a limited field of view would provide a selected roadbed, some off-road terrain, but no tactical driving capabilities. A single-station unit would operate with a model board. Use of this simulator would reduce vehicle usage for driver training by approximately 9%. Swim, drive at night, formation driving and a proficiency test would still need the actual vehicle.

(c) Use of computer generated imagery (CGI) with the limited task trainer would permit a multi-station configuration capable of training six soldiers at one time. This would be consistent with the BBC POI student to instructor ratio of 6:1.

(d) A full task trainer would permit interaction with all switches, pedals, gauges, and indicators. Visual representation would include tactical maneuvering, terrain driving in all weather, day or night. A full motion system (pitch and yaw) would limit the device to a single station training one soldier at a time.

(e) Use of a limited motion system with the full task trainer would permit a multi-station facility to train six soldiers at one time.

(2) Cost comparison of the three classes of driver trainers is presented in Table 10.

(3) Cost of the device increases with the complexity of the tasks to be trained. A full task trainer with a full motion system would be the most expensive.

(4) All devices under consideration are non-mobile. The limited and full task trainers require a structure capable of supporting the motion platform, hydraulic power unit (HPU), and, depending on the particular model, a space of approximately 200 square feet for the model board. The HPU requires a separate housing that is sound-proof with heating and air conditioning. Electrical power requirements are also to be considered. Training of a senior NCO and alternates as operators/instructors would be additional factors to consider.

Table 10

COST COMPARISON ESTIMATE OF THREE CLASSES OF DRIVER TRAINERS FOR THE BFV

TYPE OF TRAINER	# OF TRG STATIONS	ONE UNIT R&D	ONE UNIT O&S[1]	R&D 50 UNITS	R&D 70 UNITS
Part task	1	$ .2M	$.05M - .3M	$ 6.2M	$ 8.4M
Limited task	1	$ 4.0M	$ .5M - 1.5M	$ 12.5M	$ 16.8M
	6	$ 8.0M	$ .5M - 1.5M	$ 50.0M	$ 71.0M
Full task	1	$10.0M	$2.3M	$ 312.0M	$420.0M
	6	$14.0M	$2.3M	$ 87.0M	$106.0M

[1] O&S is per unit per year and includes all support activity. A range of O&S cost was established dependent on location of the device and maintenance personnel requirements. This cost will not vary with the number of units purchased.

i. EEA 9. What training alternatives are available or could enhance present driving instruction?

(1) Current mode of institutional instruction is lecture/hands-on using the actual vehicle. Instructional aids consist of transparencies on overhead projector, slides, panel description mats, video tape, forms and publications pertaining to the vehicle, and a communication panel mock-up.

(2) An aid that could supplement current driving instruction is the use of six fully operational instrument console panels and gear selector. BBC instructors indicated the need for an improved climate for the training environment in the form of adequate classrooms and an improved driving course.

(3) U.S. Army Armor School at Ft Knox, KY is evaluating a mobile driver trainer for training M1 Abrams tank drivers. At the time of this report, results of the mobile driver trainer study have not been released. Providing the concept is cost and training effective, it may be applicable to the BFV.

(4) Use of a surrogate vehicle in lieu of the Bradley was considered. Candidates were the M59 self-propelled anti-tank vehicle and M551 Sheridan tank. The M59 was eliminated from further consideration in that it does not possess the bulk of the M2. The M551 was also eliminated in that the driver's compartment is in the middle of the vehicle, whereas the M2 driver's station is on the left side of

the vehicle. What is needed is a vehicle that has a driver's station on the left side of the vehicle, with approximately the same bulk and center of gravity as the Bradley. A possibility of such a vehicle will exist in the M113A3 which will have the steering yoke and driver's station on the left side. Some modification of the console and external modification to approximate the size of the BFV would be required.

(5) Consistent use of FM 21-17, Driver Selection, Training, and Supervision, Track Combat Vehicles; FM 21-306, Manual for the Tracked Combat Vehicle Driver; and TM 9-2350-252-10-1, Technical and Operator's Manual for Fighting Vehicle, Infantry M2 and Fighting Vehicle, Cavalry, M3 would increase the awareness of selection criteria for BFV drivers and proper procedures for operating the vehicle.

j. EEA 10. What is the cost of using simulators versus vehicles for M2/M3 driver training in the institution and in BFV units?

(1) Institution

(a) Estimated costs of training six drivers at a time, 1500 students per year, are in Table 11.

Table 11

ESTIMATED COMPARATIVE COSTS OF INSTITUTIONAL DRIVER TRAINING (1500 STUDENTS)

		----SIMULATOR----		
TRAINER TYPE	# UNITS	O&S P/YR	VEHICLE USE	TOTAL COST
Part task	6 ss	$ .3M-1.5M	$1.5M	$1.8M- 3.0M
Limited task	6 ss	$3.0M-9.0M	$1.3M	$4.3M-10.3M
	1 ms	$ .5M-1.5M	$1.3M	$1.8M- 2.8M
Full task	6 ss	$ 13.8M	$1.0M	$ 14.8M
	1 ms	$ 2.3M	$1.0M	$ 3.3M
BBC	(6 BFVs)		$1.5M	$ 1.5M

ss = single station
ms = multi-station

NOTE: Part task trainer will not reduce vehicle use.
Limited task trainer could reduce vehicle use by 14%.
A full task trainer is capable of reducing vehicle use by 33%.

(b) Use of a part task trainer would not decrease use of the vehicle for driving instruction. All driving portions of the current POI would remain in effect.

(c) The limited task trainer would require use of the BFV for night driving, swim, formation driving, and a proficiency test. This assumption is based on the description of this trainer provided by PM TRADE.

(d) Most tasks could be trained on the full task trainer with the exception of swim, formation driving, and a proficiency test. The degree of proficiency to which a driver would be trained is speculative at this time.

(e) Prioritizing the available driver training options from least to the most costly results in (1) training on the actual vehicles, (2) part task trainer, (3) limited task, multi-station, (4) full task, multi-station, (5) limited task, single station, and (6) full task, single station.

(f) Table 12 projects the cost of institutional driver training using the approved POI. Even with the increased student load, use of simulators will not reduce the cost of instruction.

Table 12

PROJECTED COSTS FOR DRIVER TRAINING

FY	NUMBER OF STUDENTS[1]	VEHICLES ONLY	FULL MOTION SIMULATOR AND VEHICLE [2]
1986	1500 (1336)	$1.5M ($1.3M)	$14.8M ($14.7M)
1987	1531 (3680)	$1.5M ($3.7M)	$14.9M ($16.3M)
1988	2801 (3990)	$2.8M ($4.0M)	$15.7M ($16.6M)
1989	4565 (4600)	$4.6M ($4.6M)	$16.9M ($17.0M)
1990	2840 (6440)	$2.8M ($6.4M)	$15.8M ($18.2M)

[1] Based on ARPRINT data. Figures in parentheses are revised projections based on the fielding plan.

[2] Based on O&S costs for six full motion simulators ($13.8M) for all training except swim, formation driving and a driving proficiency test on the vehicle ($690 per student). Includes vehicle movement from storage to training areas.

(2) Unit

(a) No formal basis of issue plan (BOIP) for a BFV driver trainer has been approved at this time. For the purposes of this report, the BOIP followed general guidance of the unit-conduct-of-fire-trainer (UCOFT), one per battalion. The estimated training costs using this BOIP are depicted in Table 13.

Table 13

ESTIMATED DRIVER TRAINING COSTS IN A BFV EQUIPPED BATTALION
(Based on deploying 50 devices Armywide)

TRAINER TYPE	UNITS	- - -SIMULATOR- - - O&S P/YR	VEHICLE USE[1]	TOTAL COST P/YR
Part task	1ss	\$.05M - .25M	\$.42M	\$.47M - .97M
Limited task	1ss	\$.5M - 1.5M	\$.38M	\$.88M - 1.9M
Full task	1ss	\$ 2.3M	\$.28M	\$ 2.6M

PRESENT COST OF DRIVER TRAINING PER BATTALION (60 BFVs) \$.42M

[1] Based on 14 kilometers per driver (see EEA 5(2)(b)) multiplied by 60 vehicles by current O&S cost per kilometer (\$50).

(b) Prioritizing the cost of training drivers in a BFV equipped battalion from least to the most costly results in (1) training on the actual vehicles, (2) part task trainer, (3) limited task, multi-station, (4) limited task, single station, (5) full task, multi-station, and (6) full task, single station.

(c) Most soldiers have had some form of driving experience prior to entering the U.S. Army. It was estimated that 4 hours of simulation would be adequate for adaptation to the BFV characteristics. Use of the driver trainer in this mode at three organizational levels is depicted in Table 14, Scenario 1. As a comparison, the simulation training of 8 hours used by several foreign armies is depicted at Scenario 2.

Table 14

PROJECTED USE OF ONE DRIVER TRAINER
AT THREE LEVELS OF DEPLOYMENT

TRAINER TYPE	ESTIMATED HOURS OF USE (per driver)	DAYS TO TRAIN [1] Bn	Bde	Div
Scenario 1				
Single station	4	30	60	120
Multiple station (6)	4	5	10	20
Scenario 2				
Single station	8	60	120	240
Multiple station (6)	8	10	20	40

[1] Normal training day of 8 hours.

(d) Adjustment of the BOIP to brigade or divisional sites would decrease the number of devices required but result in a higher per unit purchase price and disproportionate periods of non-use.

(e) Use of a driver trainer exclusively for the BFV would idle the device for extended periods. Only by deploying the full task, full motion trainer at division level, with each driver receiving 8 hours of simulation training would the device reach any degree of cost efficacy. This concept would parallel foreign armies' centralized driving schools.

(f) Distribution of the driver trainer in USAREUR at brigade or higher level would involve additional costs for temporary duty (TDY) and associated transportation, housing, and feeding impacts. An additional consideration is the temporary loss of soldiers from the unit for this training. Devices placed at division level in CONUS would not, in most instances, be subject to these additional considerations.

(g) In June, 1986, a follow-up survey was sent to FORSCOM and USAREUR division, brigade, and battalion commanders, and the U.S. Army Armor School. Results at Appendix B support the findings of the study.

7. CONCLUSIONS.

a. BFV drivers are not significantly contributing to mechanical or transmission malfunctions. This is confirmed by SAR, maintenance personnel, and the transmission manufacturer.

b. No tasks were selected to be trained on a driver trainer using ARI methodology. The learning and skill analysis with the data collected from BC, driver, and instructors supports this conclusion as well. The primary factor negating selection was that driving tasks are easy to perform.

c. Although driver turbulence in units results in a new driver each year, this situation does not necessarily support or deny the requirement for a trainer. A driver trainer could provide valuable experience for the newly-assigned driver. On the other hand, it is questionable whether such an expensive device should be procured for a non-dedicated position and to support a vehicle that is easy to operate.

d. Minimum mileage is now being devoted to driver training in the unit and in the institution as determined by field data. Minimal reduction in vehicle use would be achieved if a driver trainer were developed. No reduction in mileage would be realized if the part task trainer were procurred and this class of driver trainer should not be considered.

e. Use of a driver trainer would not substantially reduce the BFV O&S cost but would present an additional cost for training both in the institution and in the units. This is due to the initial high purchase price of the device, required housing of the device which may involve new facility construction, maintenance training of operator personnel, and, depending on location of the device, associated TDY costs.

f. A driver trainer in BFV equipped units used exclusively for M2/M3 driver training would result in the device being idle for extended periods.

g. Use of simulators for BFV driver training can only be justified by a clearly defined training deficiency, a dramatic rise in number of accidents, and/or lack of vehicles or other resources to conduct training. None of these conditions has, as yet, arisen.

8. RECOMMENDATION. The proposal of using a driver simulator exclusively for training M2/M3 BFV drivers is unfounded at this time, and further efforts for its procurement should be discontinued.

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